UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

October 8, 2009

Mr. James A. Spina, Vice President
Calvert Cliffs Nuclear Power Plant, Inc.
Constellation Generation Group, LLC
1650 Calvert Cliffs Parkway
Lusby, Maryland 20657-4702

SUBJECT: CALVERT CLIFFS NUCLEAR POWER PLANT - NRC COMPONENT DESIGN BASES INSPECTION REPORT 05000317/2009006 AND 05000318/2009006

Dear Mr. Spina:

On August 28, 2009, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at the Calvert Cliffs Nuclear Power Plant. The enclosed inspection report documents the inspection results, which were discussed with Mr. S. Dean, Manager, Operations, and other members of your staff on August 28, 2009.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. In conducting the inspection, the team examined the adequacy of selected components and operator actions to mitigate postulated transients, initiating events, and design basis accidents. The inspection involved field walkdowns, examination of selected procedures, calculations and records, and interviews with station personnel.

This report documents four NRC-identified findings which were of very low safety significance (Green). All of these findings were determined to involve violations of NRC requirements. However, because of the very low safety significance of the violations and because they were entered into your corrective action program, the NRC is treating the violations as non-cited violations (NCVs) consistent with Section VI.A.1 of the NRC Enforcement Policy. If you contest any NCV in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U. S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555-0001, with copies to the Regional Administrator, Region I; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001; and the NRC Resident Inspector at the Calvert Cliffs Nuclear Power Plant. In addition, if you disagree with the characterization of any finding in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region I and the NRC Resident Inspector at the Calvert Cliffs Nuclear Power Plant.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for the public inspection in the NRC Public Docket Room or from the Publicly Available Records component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Lawrence T. Doerflein, Chief
Engineering Branch 2
Division of Reactor Safety

Docket Nos.: 50-317, 50-318
License Nos.: DPR-53, DPR-69

Enclosure: Inspection Report 05000317/2009006 and 05000318/2009006
w/Attachment: Supplemental Information

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for the public inspection in the NRC Public Docket Room or from the Publicly Available Records component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

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Docket Nos. 50-317, 50-318
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Enclosure: Inspection Report 05000317/2009006 and 05000318/2009006
w/Attachment: Supplemental Information

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REGION I

Docket No.:	50-317, 50-318
License No.:	DPR-53, DPR-69
Report No.:	05000317/2009006 and 05000318/2009006
Licensee:	Constellation Generation Group, LLC (Constellation)
Facility:	Calvert Cliffs Nuclear Power Plant, Units 1 and 2
Location:	1650 Calvert Cliffs Parkway Lusby, Maryland 20657-4702
Dates:	August 3, 2009 – August 28, 2009
Inspectors:	S. Pindale, Senior Reactor Inspector, Team Leader F. Arner, Senior Reactor Inspector M. Halter, Reactor Inspector J. Lilliendahl, Reactor Inspector C. Baron, NRC Mechanical Contractor G. Skinner, NRC Electrical Contractor
Approved by:	Lawrence T. Doerflein, Chief Engineering Branch 2 Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000317/2009006, 05000318/2009006; 08/03/2009 – 08/28/2009; Calvert Cliffs Nuclear Power Plant; Component Design Bases Inspection.

The report covers the Component Design Bases Inspection conducted by a team of four NRC inspectors and two NRC contractors. Four findings of very low risk significance (Green) were identified, which were also considered to be non-cited violations. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using NRC Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP). The cross-cutting aspects were determined using IMC 0305, "Operating Reactor Assessment Program." Findings for which the SDP does not apply may be Green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 4, dated December 2006.

NRC-Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

- Green. The team identified a finding of very low safety significance involving a non-cited violation of 10 CFR 50, Appendix B, Criterion XI, "Test Control," in that, Constellation did not assure that required testing was performed in accordance with written test procedures and that test results were documented and evaluated to verify that test requirements were satisfied. Specifically, there were instances where Constellation did not correctly calculate battery capacity, record battery voltages, and properly load the battery during the 11 and 21 station battery discharge tests. In response, Constellation entered the issue into the corrective action program and determined that there was sufficient battery margin to assure operability of the station batteries.

  The finding is more than minor because it is associated with the procedure quality attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. The team determined the finding was of very low safety significance (Green) because it was not a design or qualification deficiency, did not represent a loss of system safety function, did not represent an actual loss of safety function of a single train, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event. This finding has a cross-cutting aspect in the area of Human Performance, Resources Component, because Constellation did not ensure that complete, accurate, and up-to-date procedures were available and adequate to assure nuclear safety. Specifically, the battery discharge test procedures did not ensure that capacities were correctly calculated, critical voltages were recorded, and battery test loading parameters were correct. (IMC 0305, Aspect H.2(c)) (1R21.2.1.1.1)

- Green. The team identified a finding of very low safety significance involving a non-cited violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," in that, Constellation did not assure that the design basis was correctly translated into specifications, drawings, procedures, and instructions. Specifically, Constellation did not assure that design inputs were appropriate, calculations were performed correctly, and design changes were incorporated into the 125 Vdc system design documents. In response, Constellation entered the issue into the corrective action program and determined that the station batteries were operable based upon battery age and capacity, and an assessment of the specific deficiencies.

  This finding is more than minor because it is associated with the design control attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. The team determined the finding was of very low safety significance (Green) because it was a design or qualification deficiency that did not result in a loss of the 125 Vdc system operability or functionality. This finding has a cross-cutting aspect in the area of Human Performance, Resources Component, because Constellation did not ensure that complete, accurate, and up-to-date design documentation was available and adequate to assure nuclear safety. Specifically, Constellation did not assure that design inputs were appropriate, calculations were done correctly, and design changes were incorporated into the 125 Vdc system design documents. (IMC 0305, Aspect H.2(c)) (1R21.2.1.1.2)

- Green. The team identified a finding of very low safety significance involving a non-cited violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," in that, Constellation did not verify the adequacy of design with respect to establishing the basis for the degraded voltage relay setpoint. Specifically, the load flow calculation used a non-conservative input to justify the 4160 Vac degraded voltage setpoint; and testing that was performed to analyze motor control center contactor voltage was non-conservative.

  The finding is more than minor because it is associated with the design control attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. The team determined the finding was of very low safety significance (Green) because it was a design deficiency that did not result in the loss of electrical distribution system operability or functionality. This finding did not have a cross-cutting aspect because the most significant contributor of the performance deficiency was not reflective of current licensee performance. (1R21.2.1.2)

- Green. The team identified a finding of very low safety significance involving a non-cited violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," in that, Constellation did not ensure the adequacy of the emergency core cooling system (ECCS) design under post-accident conditions. Specifically, Constellation had not performed adequate analyses or testing to evaluate the potential impact of air being entrained in the flow from the refueling water tank (RWT) during the transition of the ECCS from the RWT to the containment sump. In response, Constellation entered this issue into their corrective action program and performed analyses to demonstrate that this condition did not render associated equipment inoperable.

This finding is more than minor because it is associated with the design control attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. The team determined the finding was of very low safety significance (Green) because it was a design or qualification deficiency confirmed not to result in a loss of ECCS operability or functionality. This finding did not have a cross-cutting aspect because the most significant contributor of the performance deficiency was not reflective of current licensee performance. (1R21.2.3.1)

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, Barrier Integrity

1R21 Component Design Bases Inspection (IP 71111.21)

.1 Inspection Sample Selection Process

The team selected risk significant components and operator actions for review using information contained in the Calvert Cliffs Nuclear Power Plant (CCNPP) Units 1 and 2 Probabilistic Risk Assessments (PRA) and the U. S. Nuclear Regulatory Commission's (NRC) Standardized Plant Analysis Risk (SPAR) models for Units 1 and 2. Additionally, the CCNPP Significance Determination Process (SDP) Phase 2 Notebooks (Revision 2.1a) for Units 1 and 2 were referenced in the selection of potential components and operator actions for review. In general, the selection process focused on components and operator actions that had a Risk Achievement Worth (RAW) factor greater than 1.3 or a Risk Reduction Worth (RRW) factor greater than 1.005. The components selected were located within both safety-related and non-safety related systems, and included a variety of components such as pumps, breakers, heat exchangers, transformers, and valves.

The team initially compiled a list of components and operator actions based on the risk factors previously mentioned. Additionally, the team reviewed the previous component design bases inspection report (05000317/2006008 and 05000318/2006008) and excluded the majority of those components previously inspected. The team then performed a margin assessment to narrow the focus of the inspection to 16 components, four operator actions and three operating experience items. The team's evaluation of possible low design margin included consideration of original design issues, margin reductions due to modifications, or margin reductions identified as a result of material condition/equipment reliability issues. The assessment also included items such as failed performance test results, corrective action history, repeated maintenance, maintenance rule (a)(1) status, operability reviews for degraded conditions, NRC resident inspector insights, system health reports, and industry operating experience. Finally, consideration was also given to the uniqueness and complexity of the design and the available defense-in-depth margins. The margin review of operator actions included complexity of the action, time to complete the action, and extent-of-training on the action.

The inspection performed by the team was conducted as outlined in NRC Inspection Procedure (IP) 71111.21. This inspection effort included walkdowns of selected components, interviews with operators, system engineers and design engineers, and reviews of associated design documents and calculations to assess the adequacy of the components to meet design basis, licensing basis, and risk-informed beyond design basis requirements. Summaries of the reviews performed for each component, operator action, operating experience sample, and the specific inspection findings identified are discussed in the subsequent sections of this report. Documents reviewed for this inspection are listed in the Attachment.

.2 Results of Detailed Reviews

.2.1 Results of Detailed Component Reviews (16 samples)

.2.1.1 11 Station Battery and 21 Battery Bus (2 samples)

a. Inspection Scope

The team reviewed the design, testing and operation of the 11 station battery and 21 battery bus (including the 21 battery) to verify that they could perform their design function of providing a reliable source of DC power to connected loads under operating, transient and accident conditions. The team reviewed design calculations to assess the adequacy of the batteries' sizing to ensure they could power the required equipment for a sufficient duration, and at a voltage above the minimum required for equipment operation. The team reviewed the DC protective coordination studies to verify that adequate protection exists for postulated faults in the DC system. The team reviewed the battery rooms' hydrogen generation calculation to verify that the hydrogen concentration levels would stay below acceptable levels during normal and postulated accident conditions. The team reviewed battery test results, including discharge tests, to ensure the testing was in accordance with design calculations, plant technical specifications, vendor recommendations, and industry standards; and that the results confirmed acceptable performance of the batteries. Design and system engineers were interviewed regarding the design, operation, testing and maintenance of the batteries. The team performed a walkdown of the 11 and 21 station batteries, associated battery chargers, and associated buses and distribution panels to assess the material condition of the battery cells and electrical equipment. Finally, a sample of condition reports was reviewed to ensure Constellation was identifying and properly correcting issues associated with the 11 and 21 station batteries and associated DC system components.

b. Findings

1. Inadequate Test Control of Safety Related Batteries

Introduction: The team identified a finding of very low safety significance (Green) involving a non-cited violation of 10 CFR 50, Appendix B, Criterion XI, "Test Control," in that, Constellation did not assure that required testing was performed in accordance with written test procedures and that test results were documented and evaluated to verify that test requirements were satisfied. Specifically, there were instances where Constellation did not correctly calculate battery capacity, record battery voltages, and properly load the battery during the 11 and 21 station battery discharge tests.

Description: The team reviewed test procedures and test results for the 11 and 21 station batteries, and identified several test control issues that affected these batteries. In particular, inadequacies in Constellation's battery discharge procedure, STP-M-55X, "Station Battery Service Test," resulted in incorrect capacity calculations, incorrect voltage recording, and incorrect loading.

Discharge tests are technical specification (TS) required tests that are performed for safety related batteries. There are two general types of discharge tests; modified performance tests and service tests. A modified performance test is used to determine the capacity of a battery, which, when trended and properly evaluated, will accurately determine when a battery is reaching the end of its service life (required performance is once every five years). A service test is used to verify that a battery is able to satisfy the design duty cycle (required performance is once every two years). The modified performance test also satisfies the requirements of a service test.

The team reviewed the last five discharge tests for the 11 and 21 batteries. The team identified two examples where capacity was incorrectly calculated.

- For the 2000 modified performance test on the 21 battery, the required test documentation provided contradicting data, which was used to determine battery capacity. Specifically, test documentation provided different test length times at different procedure steps; 193 minutes, 194 minutes, and approximately 203 minutes. The test documentation did not provide conclusive evidence for which number was correct or an explanation for why contradicting data existed. Notwithstanding, none of the three values would have yielded a result that would have rendered the battery inoperable.

- For the 2004 modified performance test on the 21 battery, the capacity was incorrectly calculated due to a personnel error (used wrong time). The team identified that the capacity recorded in the 2004 modified performance test had dropped abnormally from the previous capacity (in 2000) and that contradicting data in the test provided evidence that the capacity was actually higher than recorded. Constellation reviewed the data and agreed that the capacity was not 99.44% as recorded, but approximately 105%.

The team identified two examples where final individual cell voltages (ICVs) were not being recorded in accordance with the discharge procedures and the Institute of Electrical and Electronics Engineers (IEEE) Standard 450-1995. Specifically, STP-M-55X states, "When battery terminal voltage reaches 106 Vdc, measure the [ICVs] and record the data on Attachment 3." The team noted that during the 2004 modified performance test for the 21 battery, ICVs were taken for only 17 of the 59 cells, and for the 2008 modified performance test for the 21 battery, the ICVs were taken at 107 Vdc rather than 106 Vdc.

The 2009 service test on the 11 battery was performed during this inspection, so the team was able to obtain and review the chart recording (voltage and load vs. time) of the test, which is not normally maintained with the test records. The team determined that because the test procedure inappropriately allows the load to stabilize prior to starting the test, and because recording of data is sometimes paused while loading is changed, the recorded data did not include the actual minimum critical voltages experienced during the test.

Finally, the team identified two examples where the loading for the battery testing was incorrect. For the 2007 modified performance test on the 11 battery, the load was not maintained above the required value during the first minute due to lack of procedure clarity. In addition, for the reserve battery, which is required to be maintained capable of operating for any of the four station batteries, the 22 battery service test load profile was used because the 22 battery load profile uses more amp-hours total than the other batteries. However, the team compared the 22 battery duty cycle to the 11 battery duty cycle and determined that the 11 battery is significantly more limiting than the 22 battery for the first two minutes. The service test profile for the reserve battery was therefore not bounding for the occasions when the reserve battery was used in place of the 11 battery (procedure was incorrect).

Based on the observed deficiencies with the battery performance testing, the team concluded there was reasonable doubt whether the battery test control program would accurately record or recognize indications of a degraded battery in a timely fashion.

Constellation entered the issues into the corrective action program (CR-2009-006006) and implemented actions to evaluate and correct the deficiencies in the battery testing program. Constellation determined that there were no operability issues with either battery, and the surveillance test results did not exceed TS acceptable values. The team reviewed Constellation's basis for operability and independently evaluated battery operability. The team similarly concluded that the issues identified did not render any of the batteries inoperable, based on the magnitude of the errors and current battery capacity margin.

Analysis: The team determined that the failure to assure that required battery testing was performed in accordance with written test procedures and to assure that test results were documented and evaluated to verify that test requirements were satisfied was a performance deficiency that was reasonably within Constellation's ability to foresee and prevent. The finding was more than minor because it was associated with the procedure quality attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Also, this issue was similar to Example 2c of NRC IMC 0612, Appendix E, "Examples of Minor Issues," in that the test control inadequacies affected multiple batteries and the issue was repetitive. Traditional enforcement does not apply because the issue did not have any actual safety consequences or potential for impacting the NRC's regulatory function, and was not the result of any willful violation of NRC requirements.

In accordance with NRC Inspection Manual Chapter 0609, Attachment 4, "Phase 1 - Initial Screening and Characterization of Findings," a Phase 1 SDP screening was performed and determined the finding was of very low safety significance (Green) because it was not a design or qualification deficiency, did not represent a loss of system safety function, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event.

This finding has a cross-cutting aspect in the area of Human Performance, Resources Component, because Constellation did not ensure that complete, accurate, and up-to-date procedures were available and adequate to assure nuclear safety. Specifically, the battery discharge test procedures did not ensure that capacities were correctly calculated, critical voltages were recorded and battery test loading parameters were correct. (IMC 0305, Aspect H.2(c))

Enforcement: 10 CFR 50, Appendix B, Criterion XI, "Test Control," requires, in part, that a test program shall be established to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is performed in accordance with written test procedures and test results are documented and evaluated to assure that test requirements have been satisfied. Contrary to the above, between February 8, 2000, and August 11, 2009, Constellation did not adequately perform battery testing in accordance with test procedures, and test results were not properly documented and evaluated for the 11 and 21 station batteries. Specifically, there were instances where Constellation did not correctly calculate battery capacity, record battery voltages, and properly load the battery during the 11 and 21 station battery discharge tests. Because this violation was of very low safety significance (Green) and has been entered into Constellation's corrective action program (CR-2009-006006), this violation is being treated as a non-cited violation, consistent with Section VI.A.1 of the NRC Enforcement Policy. **(NCV 05000317/2009006-01 & NCV 05000318/2009006-01, Inadequate Test Control of Safety Related Batteries)**

2. Inadequate Design Control of DC System

Introduction: The team identified a finding of very low safety significance (Green) involving a non-cited violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," in that, Constellation did not assure that the design basis was correctly translated into specifications, drawings, procedures, and instructions. Specifically, Constellation did not assure that design inputs were appropriate, calculations were performed correctly, and design changes were incorporated into the 125 Vdc system design documents.

Description: The team reviewed E-89-005, "Station Blackout (SBO) and Loss-of-Coolant Accident (LOCA) Battery Duty Cycle 125 Vdc Bus 11," E-89-007, "SBO and LOCA Battery Duty Cycle 125 Vdc Bus 21," and E-89-042, "Voltage Drop in DC System." These calculations determined the cell sizing of the 11 and 21 safety-related station batteries. The E-89-042 calculation establishes that the batteries, as sized in E-89-005 and E-89-007, will maintain an adequately high voltage for the required components (loads). The team identified numerous and significant discrepancies in the calculations, which made the conclusions uncertain. These calculations were performed to ensure that the installed batteries are adequately sized, that the test procedures apply adequate loading to verify operability, and that operator actions taken during design basis events will assure sufficient battery capacity.

The team identified several incorrect design inputs, such as the following:

- The diesel generator field flashing circuit minimum voltage was said to be unknown;
- The sizing calculations lacked details regarding the bases for the timing for operating certain loads;
- Resistance in fuses and contacts were not addressed by the voltage drop calculation; and
- Although the sizing calculation concluded that the batteries could be operated with a cell jumpered out, the voltage drop calculation did not address the decrease in voltage to the system by removing a cell.

The team also identified two design changes that occurred prior to 2007 but were not incorporated into the design calculations; the addition of the turbine controls inverter to bus 11, and the change to the LOCA sequencing. The change to the LOCA sequencing altered the number and sequence of breakers which are closed during a postulated LOCA. This changed the battery loading because the sizing was significantly influenced by the number of loads that operate simultaneously.

Finally, the team identified two calculation errors. The first error was that the resistance for DC cables in one portion of the voltage drop calculation was not doubled as is necessary because of the positive and negative cables in a DC system. The second error was in determining starting voltages for certain scenarios that relied upon the manufacturer's battery curves. The curves were used incorrectly, which resulted in non-conservative errors.

Constellation entered these deficiencies into the corrective action program (CR-2009-006050 and CR-2009-006043) and implemented actions to evaluate and correct the deficiencies in the calculations. Constellation evaluated the specific problems identified by the team and determined that there were no operability issues with either battery. The team reviewed Constellation's basis for operability and independently evaluated battery operability. Although the nature of the issues (e.g., unknown bases and details) with the calculation were such that a quantitative change to the battery margin could not be determined, the team similarly concluded that the issues identified did not render any of the batteries inoperable, based on the current age of the batteries and a qualitative assessment of the potential change to the battery capacity margin.

Analysis: The team determined that the failure to assure that the battery design basis was correctly translated into specifications, drawings, procedures, and instructions was a performance deficiency that was reasonably within Constellation's ability to foresee and prevent. The finding was more than minor because it was associated with the design control attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Also, this issue was similar to Example 3j of NRC IMC 0612, Appendix E, "Examples of Minor Issues," in that the condition resulted in reasonable doubt of the operability of the component, and additional analyses were necessary to verify operability. Traditional enforcement does not apply because the issue did not have any actual safety consequences or potential for impacting the NRC's regulatory function, and was not the result of any willful violation of NRC requirements.

In accordance with NRC Inspection Manual Chapter 0609, Attachment 4, "Phase 1 - Initial Screening and Characterization of Findings," a Phase 1 SDP screening was performed and determined the finding was of very low safety significance (Green) because it was a design deficiency confirmed not to result in a loss of operability or functionality of the 125 Vdc system.

This finding has a cross-cutting aspect in the area of Human Performance, Resources Component, because Constellation did not ensure that complete, accurate, and up-to-date design documentation was available and adequate to assure nuclear safety. Specifically, Constellation did not assure that design inputs were appropriate, calculations were done correctly, and design changes were incorporated into the 125 Vdc system design documents. (IMC 0305, Aspect H.2(c))

Enforcement: 10 CFR 50, Appendix B, Criterion III, "Design Control," requires, in part, that the design basis be correctly translated into specifications, drawings, procedures, and instructions. Contrary to the above, when the battery sizing calculations were revised on or about March 25, 2007, Constellation did not assure that design inputs were appropriate, calculations were done correctly, and design changes were incorporated into the 125 Vdc system design documents. These 125 Vdc system design documents ensure that the installed batteries are adequately sized, that the test procedures apply adequate loading to verify operability, and that operator actions taken during design basis events will assure sufficient battery capacity. Because this violation was of very low safety significance (Green) and has been entered into Constellation's corrective action program (CR-2009-006050 and CR-2009-006043), this violation is being treated as a non-cited violation, consistent with Section VI.A.1 of the NRC Enforcement Policy. **(NCV 05000317/2009006-02 & 05000318/2009006-02, Inadequate Design Control for 125 Vdc System)**

.2.1.2 <u>4160 Vac Emergency Bus 24</u>

a. <u>Inspection Scope</u>

The team reviewed AC load flow calculations to determine whether the 4160 Vac system had sufficient capacity to support its required loads under worst case accident loading and grid voltage conditions. The team reviewed the design of the 4160 Vac bus degraded voltage protection scheme to determine whether it afforded adequate voltage to safety-related devices at all voltage distribution levels. This included reviews of degraded voltage relay setpoint calculations, motor starting and running voltage calculations, and motor control center (MCC) control circuit voltage drop calculations. The team reviewed protective relaying schemes and calculations to determine whether equipment such as motors and cables were adequately protected, and to determine whether protective devices featured proper selective tripping coordination. Maintenance procedures and schedules were reviewed to determine whether they reflected up to date vendor technical data and whether equipment was being properly maintained. The team reviewed corrective action documents and maintenance records to determine whether there were any adverse operating trends. The team reviewed operating procedures to determine whether the limits and protocols for maintaining offsite voltage were consistent with design calculations. The team reviewed the switchgear heat rise calculation to determine whether equipment was applied within its rated service conditions. Finally, the team performed a visual inspection of the 4160 Vac safety buses to assess material condition and the presence of potential hazards.

b. <u>Findings</u>

<u>Introduction</u>: The team identified a finding of very low safety significance (Green) involving a non-cited violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," in that Constellation did not verify the adequacy of design with respect to establishing the bases for the degraded voltage relay setpoint. Specifically, the load flow calculation used a non-conservative input to justify the 4160 Vac degraded voltage setpoint; and testing that was performed to analyze MCC control circuit voltage was non-conservative.

<u>Description</u>: The Calvert Cliffs safety related electrical distribution system is equipped with two levels of degraded voltage protection, which include the sustained undervoltage relays (SURs) and the transient undervoltage relays (TURs). The SUR features a setpoint of approximately 94% of nominal 4160 Vac bus voltage, with a time delay of 99 seconds. The TUR features a setpoint of approximately 89% of 4160 Vac, with a time delay of 6 seconds.

The function of the SUR was defined in Calculation CA01206, "Safety Related 4 kV Undervoltage Protection," as ensuring that safety related loads will not be operated below a minimum operating voltage of 90% of nominal rated voltage during steady state conditions. The function of the TUR was defined as ensuring greater than 75% of nominal rated voltage at all safety-related loads, as well as ensuring MCC contactors have sufficient voltage to pick up during transient voltage conditions.

Calculation CA01206 referred to a motor starting case in load flow Calculation E-94-017 to establish the adequacy of the TUR setpoint. However, calculation E-94-017 did not have a case specifically designed to establish the adequacy of the relay setpoints, and the case that was referenced was non-conservative for the purposes of Calculation CA01206. Independent calculations by the team showed that the specific case was based on bus voltage approximately 7.5% higher (non-conservative) on Bus 11 than is actually afforded by the TUR, and approximately 11.6% higher than is actually afforded by the TUR on Bus 14.

The Calvert Cliffs electrical system features simultaneous starting of several large 4160 Vac and 460 Vac motors at the start of a postulated accident when supplied from offsite power. The team determined that if actual voltages afforded by the TUR setpoint were considered, some 460 Vac motors may not have the minimum starting voltage of 75% during the transient voltage dip. In response to the team's concern, Constellation referred to historical Calculation E-92-16 that took credit for sequential starting of motors where 460 Vac motors would be able to start after the 4160 Vac motors have accelerated and bus voltage has partially recovered, although all motors would receive the start signal simultaneously. Independent calculations by the team similarly indicated that, although 460 Vac motor starting could be slightly delayed, the 460 Vac motors should start successfully. This slight delay would not challenge any design basis equipment start timing/sequence assumptions or requirements. Therefore, the team concluded there was reasonable assurance that operability was maintained for the electrical distribution system, including TUR degraded voltage protection.

In addition, the team found that the analysis of MCC control circuits voltage relied on testing rather than a formal analysis of control circuits. Calculation E-90-30, "MCC Momentary Voltage Limits," analyzed MCC contactor voltage by using test data taken in 1978 on installed control circuits, and concluded that a minimum voltage of 84.5% at the MCC bus was adequate to ensure operability of the contactors; and this was used as the acceptance criteria in Calculation CA01206. In general, the test data demonstrated contactor pickup voltages below the vendor's ratings (85% of 120 Vac at the contactor) because 84.5% at the MCC bus would result in less than 85% at the contactor due to voltage drops in the control circuits. All of the safety related 480 Vac MCC starters were subsequently replaced and the associated purchase specification (SP-0807) stipulated that a test be performed by the vendors, intended to simulate bounding field configurations, similar to the original 1978 tests. The team concluded that this approach was non-conservative for the following reasons:

- The subsequent testing was performed by two vendors, one of which did testing on only a portion of the units supplied. Due to variations in manufacture, some units that were not tested may meet the manufacturer's minimum voltage requirement of 85%, but may not pick up at the lower voltages required and demonstrated in the original tests;
- Actual service temperature of MCCs was not simulated in the tests. Elevated temperatures during heavy bus loading or loss of ventilation could cause increased resistance in circuit elements, thereby reducing voltage at the contactors; and

- No periodic testing is performed to detect age related degradation, which could result in higher pickup voltage requirements. This item was noted in CR-2009-003719 prior to this inspection, but no effort was documented assessing the adequacy of margins associated with this concern.

In response to this concern, Constellation provided data indicating that contactors would generally have substantial voltage margins to pick up during voltage recovery following the transient voltage dip. Although this could result in a slight delay in the actuation of some safety-related equipment at the start of a postulated accident, Constellation stated that this delay would be bounded by the delay involved with starting the diesel generator analyzed for an existing design basis scenario. The team reviewed this evaluation and concluded that it provided reasonable assurance of operability.

Although Constellation has demonstrated reasonable assurance of operability for both issues described above, the effect of these factors resulted in a reduction in margin in voltage available for safety-related control equipment. Constellation issued CR-2009-006045 to address the above concerns.

<u>Analysis</u>: The team determined that the failure to verify the adequacy of the design, such as by the performance of a design review, by the use of a calculational method, or by the performance of a suitable test program, was a performance deficiency that was reasonably within Constellation's ability to foresee and prevent. The finding was more than minor because it was associated with the design control attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Also, this issue was similar to Example 3j of NRC IMC 0612, Appendix E, "Examples of Minor Issues," because the condition resulted in reasonable doubt of the operability of the component, and additional analysis was necessary to verify operability. Traditional enforcement does not apply because the issue did not have any actual safety consequences or potential for impacting the NRC's regulatory function, and was not the result of any willful violation of NRC requirements.

In accordance with NRC Inspection Manual Chapter 0609, Attachment 4, "Phase 1 – Initial Screening and Characterization of Findings," a Phase 1 SDP screening was performed and determined the finding was of very low safety significance (Green) because it was a design or qualification deficiency confirmed not to result in a loss of the electrical distribution system operability or functionality. This finding did not have a cross-cutting aspect because the most significant contributor of the performance deficiency was not reflective of current licensee performance.

<u>Enforcement</u>: 10 CFR 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures be provided for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. Contrary to the above, as of August 3, 2009, Constellation's design control measures did not verify the adequacy of design with respect to establishing the bases for the degraded voltage relay setpoint. Specifically, the load flow calculation used a non-conservative input to justify the 4160 Vac degraded voltage setpoint; and testing that was performed to analyze MCC control circuit voltage was non-conservative. Because this violation is of very low safety

significance and has been entered into Constellation's corrective action program (CR-2009-006045), it is being treated as a non-cited violation consistent with Section VI.A.1 of the NRC Enforcement Policy. **(NCV 05000317/2009006-03 & 05000318/2009006-03, Inadequate Design Control for 4 kV Bus Undervoltage Protection)**

.2.1.3 Motor-Driven Auxiliary Feedwater Pump 13

a. Inspection Scope

The team inspected the 13 motor-driven auxiliary feedwater (MDAFW) pump to verify that it was capable of meeting its design basis requirements. The MDAFW pump, together with the turbine-driven pumps, was designed to provide feedwater flow to the steam generators when the normal feedwater system is not available.

The team reviewed various design calculations to verify the adequacy of the design. This review included the auxiliary feedwater system flow calculation, the pump net positive suction head (NPSH) calculation, and the condensate storage tank level analysis. The team also reviewed in-service testing procedures, acceptance criteria, and recent results to verify the current capability of the pump. The team interviewed system and design engineers, and reviewed the associated operating procedures to assess the operation and testing of the MDAFW pump. The team also performed a walkdown of the pump, condensate storage tank, and associated equipment to assess the material condition of the equipment.

b. Findings

No findings of significance were identified.

.2.1.4 Containment Spray Pump 12

a. Inspection Scope

The team reviewed the Updated Final Safety Analysis Report (UFSAR), technical specifications, licensing documents, and pump specifications to identify the design bases for containment spray pump 12. The team reviewed pump specifications to assess its ability to meet design basis head and flow requirements for spray injection into the containment. The team reviewed drawings, procedures, system health reports, corrective and preventive maintenance activities, and selected condition reports to ensure that the maintenance, testing, and operation of the containment spray pump was adequate to satisfy design basis requirements under accident conditions.

The team interviewed engineers regarding the design, operation, testing and maintenance of the pump. The team reviewed design calculations and specifications to assess the adequacy of available net positive suction head and vortex protection from both the refueling water storage tank and the containment sump during the transition to the recirculation phase of operation. The team reviewed minimum flow requirements for the pump to ensure potential pump operation on minimum flow was within vendor recommended guidelines. The team also reviewed runout protection and assessed the capability of the pump to achieve the flow and developed head as assumed in operating, transient and accident calculations. This included a review of pump test performance results to ensure actual and allowable pump performance was bounded by accident analysis assumptions for both analyzed flowrate capability and impact on emergency diesel generator loading calculations. The team also reviewed the control scheme associated with the pump start and stop logic to ensure it was consistent with accident analysis assumptions. Emergency operating procedures were reviewed to ensure they were consistent with design analyses assumptions. The team performed a field walkdown to assess the material condition of pump. A reasonable expectation for operability (RECO) associated with minimum flow capability for the containment spray pump 22 was reviewed due to its potential generic applicability to pump 12. Finally, the team reviewed the cooling associated with the pump bearings to ensure capability under design basis conditions.

b. Findings

No findings of significance were identified.

.2.1.5 Turbine-Driven Auxiliary Feedwater Pump 21 Governor Control System

a. Inspection Scope

The team inspected the turbine-driven auxiliary feedwater (TDAFW) pump governor controls, to verify that the control system was capable of meeting the pump design basis requirements. The TDAFW pump was designed to provide feedwater flow to the steam generators when the normal feedwater system is not available. The pump's motive force is provided by a steam turbine supplied from the main steam system. In addition, the pump has a risk significant function to provide feedwater flow to the steam generators in the event of a station blackout.

The team reviewed the capability of the TDAFW governor control system to perform its required function under limiting operating conditions such as a loss of the normal instrument air supply signal to the governor speed control. The review included calculations associated with the determination of maximum flow conditions for the pump along with the net positive suction head analysis. The team reviewed the control system to ensure operation was consistent with design analysis assumptions for turbine/pump speed performance. The team reviewed operating procedures, surveillance test procedures and recent pump test results to verify the capability of the governor to ensure the pump performs in accordance with design assumptions. The team reviewed vendor data sheets for the governor control oil along with maintenance results for oil analyses to determine if control oil was maintained in accordance with vendor recommendations. The team also reviewed maintenance schedules for the rebuild of the governor to ensure consistency with vendor recommendations. The team reviewed the technical specification requirements associated with the TDAFW pump to ensure the pump was operated and tested as required. Condition reports and maintenance history relative to the control system performance for both the Unit 1 and Unit 2 TDAFW pumps were reviewed to assess the potential for generic concerns and to evaluate the effectiveness of corrective actions. The team interviewed the system and design engineers, and performed a walkdown of the TDAFW pump controls, turbine and associated equipment, to assess the material condition of the components.

b. Findings

No findings of significance were identified.

.2.1.6 Motor-Driven Auxiliary Feedwater Pump 23 Flow Control Valve, 2-CV-4525

a. Inspection Scope

The team inspected the motor-driven auxiliary feedwater (MDAFW) pump flow control valve (2-CV-4525) to the steam generator to verify that the valve was capable of supporting the pump design basis requirements. The team reviewed the valve and actuator specification/design sheets to ensure the valve installed in the field was consistent with the design. The team reviewed thrust capability calculations associated with the valve to ensure the valve actuator was capable of providing the required thrust for both the open and closed positions. The team also reviewed associated in-service tests (IST) for the valve to ensure valve performance was being monitored in accordance with IST program requirements.

The team reviewed operating procedures for both transient and accident conditions to determine if the valve was being operated in accordance with accident analysis assumptions. The team also reviewed the motive force for the valve actuators through a walkdown of the valve and its associated safety air system supply to determine if the air supply would be available for operation of the valve during postulated transients. The UFSAR, technical specifications, accident analyses, and design basis documents were reviewed to ensure that design and licensing bases were met. Finally, the team interviewed system and design engineers to discuss recent condition reports and maintenance history for the valve in order to determine the overall condition of the valve.

b. Findings

No findings of significance were identified.

.2.1.7 High Pressure Safety Injection Valve, MOV 627

a. Inspection Scope

High pressure safety injection (HPSI) system injection valve MOV 627 was inspected as a representative sample to ensure the HPSI injection valves were capable of performing their design function. The team reviewed the valve operating logic and completed surveillance test results to verify valve controls would function to provide the desired response to an actual or simulated initiation signal. The team interviewed system and design engineers to ensure appropriate assumptions had been used in associated valve calculations. The valve capability calculations were reviewed to verify that the thrust and torque limits and actuator settings were correct and based on appropriate design conditions such as maximum expected differential pressures. The UFSAR, technical specifications, design basis documents and emergency operating procedures were reviewed to ensure that design and licensing bases assumptions were met. System health reports, condition reports and corrective maintenance history were reviewed to verify that potential degradation was identified and corrected. The team also reviewed the vendor analysis associated with throttling capability of the valve and recommendations for maximum throttling conditions to prevent long term wear and potential plugging concerns when pump operation is from the containment sump. Finally, a walkdown was performed to assess the material condition of the valve and to verify that the installed configuration would support its design basis function under transient and postulated accident conditions.

b. Findings

No findings of significance were identified.

.2.1.8 480 Vac Load Center Bus 14A

a. Inspection Scope

The team reviewed AC load flow calculations to determine whether the 480 Vac bus had sufficient capacity to support its required loads under worst case accident loading and grid voltage conditions. The team reviewed the degraded voltage protection scheme to determine whether the voltage setpoints were selected based on the voltage requirements for safety related loads at the 480 Vac level. The team reviewed breaker coordination studies to determine whether equipment was protected and whether protective devices featured selective coordination. The team reviewed maintenance procedures, schedules, and records for the 480 Vac load centers and their associated circuit breakers to determine whether equipment was being properly maintained. Corrective action documents and maintenance records were reviewed to determine whether there were any adverse operating trends and to determine whether the cause of equipment deficiencies had been identified and corrective actions were adequate. The team reviewed the switchgear heat rise calculation to determine whether equipment was applied within its rated service conditions. In addition, the team performed a visual inspection of the 480 Vac safety buses to assess material condition and the presence of potential hazards.

b. Findings

No findings of significance were identified.

.2.1.9 13 kV – 4 kV Transformer, U4000-11

a. Inspection Scope

The team reviewed relay connection drawings and calculations to determine whether protective schemes and settings were adequate to protect the transformer from overcurrent conditions, and whether the relaying was subject to spurious tripping under expected in-rush and loading currents. The team reviewed maintenance schedules, procedures, vendor manuals, and completed work records to determine whether the transformer was being properly maintained. The team reviewed corrective action histories to determine whether there had been any adverse operating trends; and reviewed corrective action documents to determine whether the cause of equipment problems had been identified and corrective actions were adequate. In addition, the team performed a visual inspection of the U4000-11 transformer to assess material condition and the presence of potential hazards.

b. Findings

No findings of significance were identified.

.2.1.10 Emergency Diesel Generator 1A (Electrical)

a. Inspection Scope

Emergency diesel generator (EDG) protective relay calculations and setting sheets were reviewed for selected relays to determine whether the setpoint basis was consistent with design bases and whether the required setpoints had been incorporated into calibration documents. The team reviewed EDG relay logic to determine whether protective functions were either retained or bypassed during emergency operation as required by the design bases. The team reviewed static loading calculations to determine whether expected worst case loading was within the rated capabilities of the engine and generator. Dynamic loading calculations were evaluated to determine whether EDG frequency response was consistent with the design bases. The team assessed short circuit calculations prepared for the modification for EDG 1A to determine whether additional contribution of the EDG and its support systems was within the capabilities of existing switchgear. The team reviewed voltage drop calculations for EDG support systems to determine whether adequate voltage was available to support the loads under degraded voltage conditions and maintain the EDG in a state of readiness. The team also reviewed corrective action documents to determine whether there were any adverse operating trends or existing issues affecting EDG reliability. Finally, the team performed a visual examination of the EDG and its environs to assess material condition and the presence of potential hazards.

b. Findings

No findings of significance were identified.

.2.1.11 Emergency Diesel Generator 1A (Mechanical)

a. Inspection Scope

The team inspected the mechanical aspects of the 1A EDG to verify that it was capable of meeting its design basis requirements. This EDG provides vital AC power if normal off-site power is not available. The team inspected the diesel cooling system, air starting system, and fuel oil system to verify the capability of those systems to perform their required functions. The diesel cooling system included heat exchangers, cooling fans, and associated equipment. The air start system included non-safety related air compressors, safety-related air receiver tanks, and associated piping and valves. The air receiver tanks are normally maintained in a pressurized condition to provide motive force to automatically start the diesel engine when required. The fuel oil system included a fuel storage tank, associated piping and valves.

This team reviewed the capabilities of the EDG support systems to perform their required functions under limiting operating conditions. The review included vendor information, analyses, procedures and recent test results. The review also included the capacity and testing of the air start system. The capability and capacity of the fuel oil system was assessed to verify its ability to perform its design basis function, and included an evaluation of the use of ultra-low sulfur diesel fuel. The team interviewed the system engineer and performed a walkdown of diesel generator building and equipment to assess the material condition of the equipment.

b. Findings

No findings of significance were identified.

.2.1.12 Service Water Pump 12

a. Inspection Scope

The team inspected the 12 service water pump to verify that it was capable of meeting its design basis requirements. The service water pump was part of a closed loop cooling system designed to remove heat under both normal and post-accident conditions.

The team reviewed the capability of the service water pump to perform its required function under limiting operating conditions. The review included flow analyses, operating procedures, test procedures and recent pump test results. The team also evaluated the capability of the system to operate under post-accident conditions with leakage through isolation valves to verify the capability of the pump to fulfill its required mission. The team interviewed system and design engineers, and performed a walkdown of the pump and associated equipment to assess the material condition of the equipment.

b. Findings

No findings of significance were identified.

.2.1.13 Power Operated Relief Valve, 2ERV402

a. Inspection Scope

The team inspected the 2ERV402 power operated relief valve (PORV) to verify that it was capable of meeting its design basis requirements. The valve is designed to provide a relief path from the reactor coolant system. The team reviewed the capability of the PORV to perform its required functions under limiting oprating conditions. The review included operating and test procedures and recent test results. The team interviewed the system engineer, and discussed the current condition of the valve, its associated maintenance history, and recent test results. A sample of condition reports was reviewed to verify that potential performance degradation was identified and corrected.

b. Findings

No findings of significance were identified.

.2.1.14 4 kV – 480 Vac Transformer, 2XU-440-21B

a. Inspection Scope

The team reviewed AC load flow calculations to determine whether 4 kV - 480 Vac transformer 2XU-440-21B had sufficient capacity to support its required loads under worst case accident loading and grid voltage conditions. The team reviewed corrective action documents and maintenance records to determine whether there were any adverse operating trends. Relay setpoint calculations and breaker coordination studies were reviewed to determine whether the transformer was protected, protective devices featured selective coordination, and the relaying was subject to spurious tripping under expected inrush and loading currents. In addition, the team performed a visual inspection of the 2XU-440-21B transformer to assess material condition and the presence of potential hazards.

b. Findings

No findings of significance were identified.

.2.1.15 Salt Water Pump Motor 23

a. Inspection Scope

The team inspected salt water pump motor 23 to verify it could respond to all design basis events. The team conducted a walkdown of the associated pump and motor to assess the material condition of the equipment. The team reviewed inspection and testing procedures to verify that appropriate preventive maintenance and surveillance activities were being performed. The team reviewed a sample of condition reports to assess the adequacy of corrective actions taken to address discrepancies. The team reviewed design documents and drawings to evaluate the ability of the pump motor to perform its design functions. The team interviewed the system engineer regarding the maintenance and operation of the pump and associated breaker. The team reviewed the AC load flow studies to verify that adequate voltage would be available at the pump motor for all design conditions.

b. Findings

No findings of significance were identified.

.2.2 Detailed Operator Action Reviews (4 samples)

The team assessed manual operator actions and selected a sample of four operator actions for detailed review based upon risk significance, time urgency, and factors affecting the likelihood of human error. The operator actions were selected from a probabilistic risk assessment (PRA) ranking of operator action importance based on risk reduction worth (RRW) and risk achievement worth (RAW) values. The non-PRA considerations in the selection process included the following factors:

- Margin between the time needed to complete the actions and the time available prior to adverse reactor consequences;
- Complexity of the actions;
- Reliability and/or redundancy of components associated with the actions;
- Extent-of-actions to be performed outside of the control room;
- Procedural guidance to the operators; and
- Amount of relevant operator training conducted.

.2.2.1 Trip Reactor Coolant Pumps Following Loss of Component Cooling Water (Unit 1)

a. Inspection Scope

The team reviewed the operator action to secure the reactor coolant pumps (RCP) upon loss of component cooling water (CCW) following a reactor trip. The team reviewed the PRA studies to determine how quickly the operators were credited with securing the RCPs to prevent an RCP seal loss-of-coolant accident. The team reviewed the associated emergency and abnormal operating procedures to ensure the operators were provided with clear guidance to perform the action as credited. The team conducted a walkdown of the associated annunciators and instrumentation on the main control room panels. In addition, the team observed operator responses during a simulator run and interviewed the operators on indications and responses to assess operator knowledge of and ability to perform the required procedural actions. Finally, the team reviewed a sample of condition reports associated with this operator action to assess the timeliness and appropriateness of corrective actions taken to ensure the action can be completed as required.

b. Findings

No findings of significance were identified.

.2.2.2 Locally Control Auxiliary Feedwater Flow During Control Room Fire (Unit 1)

a. Inspection Scope

The team reviewed the operator action to locally control auxiliary feedwater flow following a control room evacuation due a fire. The team reviewed the bases of the assumptions used to determine the time required to take appropriate manual action. The team conducted interviews with operators to assess operator knowledge of and ability to operate applicable equipment and to verify that the manual action could be accomplished in the required time. The team performed a walkdown of the associated areas to assess equipment material condition; and to ensure the areas, equipment, and instrumentation were accessible. The team reviewed emergency and abnormal operating procedures to verify that the procedures provided clear steps to complete the manual action. Additionally, the team reviewed condition reports and completed surveillances to assess the overall health of the affected equipment.

b. Findings

No findings of significance were identified.

.2.2.3 Align Alternate Component Cooling Water Pump to 480 Vac Bus (Unit 2)

a. Inspection Scope

The team reviewed the manual operator action to align the alternate CCW pump for 480 Vac power following a loss-of-offsite power and loss-of-coolant accident, coincident with the failure and/or unavailability of the other CCW pumps. The team reviewed the bases of the assumptions used to determine the time required to take appropriate manual action. The team observed the postulated scenario in the simulator to verify instrumentation and alarms were available to operators for identifying required manual actions. The team then conducted a walkdown with operators to assess operator knowledge of and ability to operate applicable equipment, assess equipment material condition, and verify that the manual action could be accomplished in the required time. The team reviewed emergency and abnormal operating procedures to verify that the procedures provided clear steps to complete the manual action. Operator interviews were conducted to identify potential challenges in performing the manual operator action. The team reviewed condition reports and completed surveillances associated with this operator action to assess the overall health of the affected equipment.

b. Findings

No findings of significance were identified.

.2.2.4 Manually Control Auxiliary Feedwater Flow (Unit 2)

a. Inspection Scope

The team reviewed the operator action required to manually control turbine-driven auxiliary feedwater pump flow following a station blackout and subsequent depletion of the station batteries. The team reviewed the PRA studies to determine when and how quickly operators are credited with gaining control of auxiliary feedwater flow. The team reviewed the bases of the assumptions used to determine the time required to take appropriate manual action. The team interviewed licensed operators and training staff to assess operator knowledge of and ability to operate applicable equipment and instrumentation. The team reviewed associated operating and emergency procedures to ensure this action could be performed as credited. The team performed a walkdown of the associated areas to ensure the areas, equipment, and instrumentation were accessible.

b. Findings

No findings of significance were identified.

.2.3 Review of Industry Operating Experience and Generic Issues (3 samples)

The team reviewed selected operating experience issues for applicability at CCNPP. The team performed a detailed review of the operating experience issues listed below to verify that Constellation had appropriately assessed potential applicability to site equipment at both Units 1 and 2, and initiated corrective actions when necessary.

.2.3.1 NRC Information Notice 2006-21, Operating Experience Regarding Entrainment of Air into Emergency Core Cooling and Containment Spray Systems

a. Inspection Scope

The team evaluated Constellation's applicability review and disposition of NRC Information Notice (IN) 2006-21. The NRC issued this IN to inform licensees of several events that have occurred at nuclear power facilities involving possible entrainment of air into emergency core cooling system (ECCS) and containment spray system piping. Air entrained in pump suction supply piping can impact the capability of these pumps to perform their specified safety functions. The team assessed Constellation's evaluation of this potential condition by reviewing specific calculations and conducting interviews with engineering personnel.

b. Findings

Introduction: The team identified a finding of very low safety significance (Green) involving a non-cited violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," in that, Constellation did not ensure the adequacy of the ECCS design under post-accident conditions. Specifically, Constellation did not evaluate the potential impact of air being entrained in the flow from the refueling water tank (RWT) during the transition of the ECCS from the RWT suction source to the containment sump during a postulated design basis loss-of-coolant accident .

Description: The team reviewed Constellation's internal evaluation of NRC IN 2006-21. The IN addressed, in part, a design issue that would allow potential air entrainment into the ECCS during the transition of the ECCS suction source from the RWT to the containment sump. Specifically, the water level in the RWT could fall below the level of the tank's suction supply line after the containment sump isolation valves automatically open in response to a recirculation actuation signal (RAS). This condition existed because the subject design did not include automatic closure of the RWT isolation valves upon a RAS, and because the post-accident containment pressure might not be sufficient to prevent continued flow from the tank after opening the containment sump isolation valves. Continued flow from the RWT, with a partially uncovered supply line would result in potential air entrainment into the ECCS and associated pumps. The CCNPP piping configuration from the RWT consists of a horizontal section, which then turns to a downward vertical section via a 90 degree elbow.

Constellation's evaluation of NRC IN 2006-21 stated that the issue would not impact pump operation based on engineering evaluations. The team reviewed Calculation CA04891, "Evaluation of Vortexing in the RWT and Resultant Void Fraction (post RAS)," which addressed this issue. The team concluded that the calculation did not correctly determine the maximum potential air entrainment to the pumps. Specifically, this calculation was based on the assumption that the check valve in the 18-inch horizontal piping from the RWT would close with 13.5 inches of water remaining in the piping due to limited differential pressure. The team determined that this assumption was not bounding for post-RAS ECCS operation because the check valve would remain open at the analyzed containment pressure profile. The team concluded that Constellation did not adequately determine the potential air entrainment under the limiting post-accident conditions.

In response to this issue, Constellation initiated CR-2009-005881 and performed a Reasonable Expectation of Continued Operability (RECO) evaluation, dated August 21, 2009, to verify ECCS operability. The RECO used a more limiting method to determine the maximum ECCS air entrainment and determined that the void fraction at the ECCS pumps' suction would be 4.9% or less, a value previously accepted by the high pressure safety injection (HPSI) pump vendor.

In addition, the inspection team reviewed Calculation CA04750, which addressed the void fraction at the ECCS pumps' suction due to air entrainment from the RWT prior to opening of the containment sump isolation valves (pre-RAS). This calculation used the methodology of NUREG-0897, Rev. 1, "Containment Emergency Sump Performance," to predict the ECCS void fraction. However, this calculation did not use the void fraction limit of 2 percent addressed by the NUREG. Assumption 4.3 of the calculation stated that it is not mandatory that the void fraction be kept below 2 percent because air ingestion from the RWT is short-term. The calculation also stated that the void fraction at the HPSI pump would start to exceed 2 percent approximately 5 minutes prior to the RAS. The most limiting void fraction predicted by Calculation CA04750 is less than 4.76 percent for a HPSI pump.

The team noted that the void fraction acceptance criterion for both the design calculation CA04750 (pre-RAS) and the RECO associated with CR-2009-005881 (post-RAS) were based on potentially exceeding 2 percent at the ECCS pumps for several minutes. It did not appear that this acceptance criterion was consistent with current regulatory or industry guidance for use as a design value, and appeared to result in a low margin design condition, especially for the HPSI pumps. Specifically, in a letter to the Nuclear Energy Institute dated May 28, 2009, the NRC documented its preliminary assessment of responses and future review plans associated with NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," and stated that void acceptance criteria should be consistent with Revision 2 to NRC Staff Criteria for Gas Movement in Suction Lines and Pump Response to Gas, dated March 26, 2009. In that document, the steady state void fraction criterion is 2% and the transient void fraction criterion is 5% (these criteria are associated with specific operational and design variables such as flow rate, pump design, etc.). While steady state operation is not defined, it was previously considered to be greater than 20 seconds. The NRC also stated in that document that other void fraction criteria may be used if an acceptable justification is provided and represents a reasonable expectation of operability. The team concluded that based on the results of Constellation's existing analysis (and independent calculations by the team), the duration of the RAS operation, the specific pump design, and vendor pump performance input, there was a reasonable expectation of operability (using 5% void fraction as an operability acceptance criterion). However, the team considered this criterion to represent an operable but non-conforming condition as the steady state void fraction criterion is 2%. The team noted that this issue will be further reviewed during the NRC's review of Constellation's response to Generic Letter 2008-01 and the followup inspection performed under Temporary Instruction 2515/177, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems (NRC Generic Letter 2008-01." In response, Constellation initiated CR-2009-06099 to address this concern associated with the ECCS void fraction design value.

<u>Analysis</u>: The team determined that the failure to ensure the adequacy of the design of the ECCS under limiting post-accident conditions was a performance deficiency that was reasonably within Constellation's ability to foresee and prevent. The finding was more than minor because it was associated with the design control attribute of the Mitigating Systems Cornerstone and affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Also, this issue was similar to Example 3j of IMC 0612, Appendix E, "Examples of Minor Issues," because the condition resulted in reasonable doubt of the operability of the component, and additional analysis was necessary to

verify operability. Traditional enforcement does not apply because the issue did not have any actual safety consequences or potential for impacting the NRC's regulatory function, and was not the result of any willful violation of NRC requirements.

In accordance with NRC Inspection Manual Chapter 0609, Attachment 4, "Phase 1 – Initial Screening and Characterization of Findings," a Phase 1 SDP screening was performed and determined the finding was of very low safety significance (Green) because it was a design or qualification deficiency confirmed not to result in a loss of ECCS operability or functionality. This finding did not have a cross-cutting aspect because the most significant contributor of the performance deficiency was not reflective of current licensee performance.

Enforcement: 10 CFR 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures be provided for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. Contrary to the above, prior to August 21, 2009**,** Constellation had not ensured the adequacy of the design of the ECCS under limiting post-accident conditions. Specifically, the licensee had not performed adequate analyses or testing to evaluate the potential impact of air being entrained in the flow from the RWT during the transition of the ECCS from the RWT to the containment sump. Because this violation is of very low safety significance and has been entered into the licensee's corrective action program (CR-2009-005881 and CR-2009-06099), it is being treated as a non-cited violation consistent with Section VI.A.1 of the NRC Enforcement Policy. **(NCV 05000317/2009006-04 & 05000318/2009006-04, Inadequate Design Control for Potential Air Entrainment in the ECCS)**

.2.3.2 NRC Information Notice 2008-09, Turbine-Driven Auxiliary Feedwater Pump Bearing Issues

a. Inspection Scope

The team reviewed the applicability and disposition of NRC IN 2008-09. The NRC issued this IN to alert licensees to issues with TDAFW pumps, as they relate to the importance of having accurate maintenance instructions and effective post-maintenance testing. The team reviewed Constellation's evaluation of the issues discussed in the information notice. Specifically, the team reviewed Constellation's barrier analysis template which addressed each concern and the controls in place to ensure the issues were addressed. The team also interviewed plant personnel to discuss a sample of the controls in place relative to the maintenance of the TDAFW pump. This review included standard administrative procedures which list the testing requirements specific to TDAFW pumps as well as what is required following pump and governor oil changes.

b. Findings

No findings of significance were identified.

.2.3.3 NRC Information Notice 2007-034, Operating Experience - Electrical Circuit Breakers

a. Inspection Scope

The team evaluated Constellation's applicability review and disposition of NRC IN 2007-034. The NRC issued this IN to inform licensees about operating experience regarding low, medium and high-voltage circuit breakers. The team reviewed Constellation's evaluation of the performance and work practices regarding circuit breakers. Specifically, the team reviewed the procedure and corrective action documents to validate adequate measures were in place to limit the likelihood of circuit breaker issues as described in the IN.

b. Findings

No findings of significance were identified.

4. OTHER ACTIVITIES

4OA2 Identification and Resolution of Problems (IP 71152)

The team reviewed a sample of problems that Constellation had previously identified and entered into the corrective action program. The team reviewed these issues to verify an appropriate threshold for identifying issues and to evaluate the effectiveness of corrective actions. In addition, condition reports written on issues identified during the inspection were reviewed to verify adequate problem identification and incorporation of the problem into the corrective action system. The specific corrective action documents that were sampled and reviewed by the team are listed in the attachment.

b. Findings

No findings of significance were identified.

4OA6 Meetings, Including Exit

The team presented the preliminary inspection results to Mr. S. Dean, Manager, Operations, and other members of Constellation staff, at an exit meeting on August 28, 2009. The team verified that none of the information in this report is proprietary.

ATTACHMENT

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

J. Beasley	System Engineer
K. Bodine	System Engineer
R. Conley	System Engineer
G. Dare	System Engineer
J. Delgado	System Engineer
A. Drake	Design Engineer
P. Fatka	System Engineer
M. Gahan	General Supervisor - Design Engineering
W. Holsten	Training Manager
J. Koelbel	Senior Engineer (PRA)
S. Loeper	System Engineer
M. Massound	Fuels Engineer
A. Simpson	Principal Engineer
R. Stark	Design Engineer
J. Suarez-Murias	Design Engineer
W. Wilson	Design Engineer

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened and Closed

NCV	05000317/2009006-01 05000318/2009006-01	Inadequate Test Control of Safety Related Batteries (Section 1R21.2.1.1.1)
NCV	05000317/2009006-02 05000318/2009006-02	Inadequate Design Control for 125 Vdc System (Section 1R21.2.1.1.2)
NCV	05000317/2009006-03 05000318/2009006-03	Inadequate Design Control for 4 kV Bus Undervoltage Protection (Section 1R21.2.1.2)
NCV	05000317/2009006-04 05000318/2009006-04	Inadequate Design Control for Potential Air Entrainment in the ECCS (Section 1R21.2.3.1)

LIST OF DOCUMENTS REVIEWED

Calculations and Evaluations:

21464, Diesel Generator Project (Part A), Rev. 1
AIT 4B200600177, Update to OE21610, 9/15/06
AIT 4B200600357, INFON 06-21, 12/26/06
CA00023, EDG Load Flow and Fault Calculations, Rev. 0
CA01206, Safety Related 4 kV Undervoltage Protection, Rev. 4
CA03385, Unit 1 Service Water Flow Analysis, Rev. 1
CA03414, NPSH and Maximum Allowable Flows for Combinations of AFW Pumps, Rev. 0
CA03474, Thrust Calculation for Unit 1 GL 89-10 MOVs, Rev. 1
CA03550, Required Thrust and Actuator Capability for Diaphragm AOVs, Rev. 1
CA03716, 13 kV Voltage Regulator Control Settings, Rev. 1
CA04380, Effects of AFW Operation During SBO on SG Water Levels, Rev. 0
CA04467, AFW Pump Room Temperature Analysis Using GOTHIC Code, Rev. 0
CA04581, Maximum HPSI and LPSI Flow for Containment Atmosphere Response, Rev. 1
CA04750, Vortexing in the RWT & Void Fraction at ECCS Pumps (Pre-RAS), Rev. 2
CA04867, Prediction of Max Flowrate in RWT Outlet Nozzle at Low-Water Levels, Rev. 2
CA04867, Prediction of Max Flowrate in RWT Outlet Nozzle at Low-Water Levels, Rev. 0
CA04891, Evaluation of Vortexing in the RWT and Resultant Void Fraction (Post-RAS), Rev. 1
CA04903, Compute the Minimum Time to RAS, Rev. 2
CA05689, Minimum Performance Criteria for HPSI, LPSI, & CS Pump Large Flow Tests, Rev. 1
CA06419, AFW System & CST Evaluation for 1.7% Power Uprate, Rev. 0
CA06551, Unit 1 and 2 SBLOCA ECCS Performance Analysis, Rev. 1
CA06762, Switchgear Hotspot Temperature Evaluation, Rev. 2
CA06946, Voltage Drop at 1A EDG Fan Actuators F10 & F12 and Damper Actuator D12, Rev. 0
CA07045, Margin Analysis - ECCS Pump NPSH/Containment Sump Strainer Flashing, Rev. 0
CA07096, NPSH Analysis of SI and CS Pumps During Post-RAS Operation, Rev. 0
CCNPP Risk Evaluation of Excessive Time to Secure RCPs in AOP-9A, 6/25/07
D-E-92-001, New DG Short Circuit and Voltage Drop Calculation, Rev. 2
D-E-94-001, Relay Settings and Coordination, Rev. 7
D-E-94-003, DG1A/DG0C Protective Relay Settings, Rev. 3
D-E-95-001, Diesel Generator Project, Rev. 0
D-M-92-008, HVAC – Diesel Generator Building, Rev. 1
D-M-92-010, Sizing the Fuel Oil Tank, Rev. 0
E-85-010, 125 Vdc Fault Current Calculation, Rev. 2
E-85-011, Hydrogen Generation for 125 Vdc Batteries, Rev. 1
E-87-009, 125 Vdc System Short Circuit Review, Rev. 1
E-88-015, EDG Loading Calculation, Rev. 3
E-89-005, SBO and LOCA Battery Duty Cycle 125 Vdc Bus 11, Rev. 3, CCN 9
E-89-007, SBO and LOCA Battery Duty Cycle 125 Vdc Bus 21, Rev. 3, CCN 4
E-89-042, Voltage Drop in DC System, Rev. 3
E-90-022, Large Motor Data for Load Flow and Short Circuit, Rev. 8
E-90-033, Master Fault Calculation, Rev. 2
E-90-038, MOV Minimum Voltages Lasting Longer than 5 Seconds, Rev. 9
E-90-30, MCC Momentary Voltage Limits, Rev. 1
E-90-41, Minimum MCC Voltage Requirements, Rev. 0
E-90-58, Protective Relay Setpoint Calculation for 13.8 kV Breakers, Bus 11, Rev. 2
E-90-81, 4 kV Bus 24 Protective Devices, Rev. 4

E-90-91, Protective Relay Setpoint Calculation for 480 Vac Bus 14A, Rev. 1
E-94-017, Plant Electrical Load Flow Analysis, Rev. 2
ES200001138, Determination of Worst Case Operating Conditions for AFW AOVs, Rev. 0
ETP 94-027, 1A DG Starting Air Consumption Test, Rev. 0
I-87-7, Capacity of Condensate Storage Tank No 12, Rev. 0
M-85-008, AFW Flow Calcs with Motor-Driven Pump ARC Valve Function Removed, Rev. 6
M-88-13, AFW and ECCS Recirculation – IE Bulletin 88-04, Rev. 0
M-91-065, Maximum Line Differential Pressure, Valves 617, 627, 637 & 647, Rev. 0
M-91-44, Velan MOV Maximum Thrust Calculation, Rev. 2
M-92-234, Service Water System Maximum Leakage, Rev. 0
NEU 94-245, Personnel Dose Associated with Aligning a CS Pump for SI, 8/29/94
SET Job No. 930494, Evaluation of the Cooling Water Systems Single Failure Analysis, 2/17/94

Completed Surveillance, Maintenance and Modification Testing:

ETP 96-091, 21 Station Battery Post Replacement Test (12/5/97)
MOV-009, Operating the Votes 100 System (2/16/1997)
OI-3B (Section 6.1.1), Unit 1 Normal Initiation of Shutdown Cooling (2/22/06, 12/19/06)
STP O-5A-2, Auxiliary Feedwater System Quarterly Surveillance Test (6/9/09)
STP O-73A-2, SW Pump and Check Valve Quarterly Operability Test (1/7/09, 4/7/09, 7/6/09)
STP O-73G-2, HPSI Pump Large Flow Test (2/27/09)
STP O-73H-2, AFW Pump Large Flow Test (2/17/09)
STP O-73M-1, Containment Spray Flow Test (3/2/08)
STP O-7A-2, A Train Engineered Safety Features Logic Test (6/6/09)
STP-M-152-1, 11 Station Battery Weekly Check (6/25/09, 7/2/09, 7/9/09)
STP-M-152-2, 21 Station Battery Weekly Check (6/23/09, 6/30/09, 7/7/09)
STP-M-352-1, 11 Station Battery Quarterly Check (1/8/09, 4/10/09, 7/9/09)
STP-M-352-2, 21 Station Battery Quarterly Check (10/14/08, 1/13/09, 4/14/09)
STP-M-552-1, 11 Station Battery Service Test (8/4/99, 9/11/01, 8/25/03, 9/1/05, 9/4/07, 8/11/09)
STP-M-552-2, 21 Station Battery Service Test (2/8/00, 2/5/02, 5/27/04, 5/30/06, 6/11/08)

Corrective Action Documents:

IR0-053-207	IRE-025-216	CR-2009-002116	CR-2009-005634*
IR3-036-477	IRE-027-398	CR-2009-002332	CR-2009-005639*
IR4-013-609	IRE-027-686	CR-2009-002357	CR-2009-005654*
IRE-003-285	IRE-032-206	CR-2009-003547	CR-2009-005661*
IRE-010-815	IRE-032-517	CR-2009-003717	CR-2009-005672*
IRE-011-694	IRE-032-766	CR-2009-003729	CR-2009-005676*
IRE-013-178	CR 2008-000558	CR-2009-003730	CR-2009-005701*
IRE-014-425	CR 2009-003933	CR-2009-003785	CR-2009-005868*
IRE-014-633	CR-2008-000336	CR-2009-003934	CR-2009-005880*
IRE-019-649	CR-2008-000852	CR-2009-004060	CR-2009-005881*
IRE-019-650	CR-2008-001184	CR-2009-005288	CR-2009-005905*
IRE-019-747	CR-2008-001686	CR-2009-005289	CR-2009-005921*
IRE-020-423	CR-2009-000305	CR-2009-005305	CR-2009-005938*
IRE-023-627	CR-2009-000630	CR-2009-005375	CR-2009-005939*
IRE-025-071	CR-2009-000650	CR-2009-005605*	CR-2009-005940*
IRE-025-083	CR-2009-000846	CR-2009-005629	CR-2009-006006*
IRE-025-194	CR-2009-000966	CR-2009-005631*	CR-2009-006007*

CR-2009-006011*	CR-2009-006044*	CR-2009-006072*	CR-2009-006109*
CR-2009-006024*	CR-2009-006045*	CR-2009-006075*	CR-2009-006114*
CR-2009-006031*	CR-2009-006050*	CR-2009-006078*	CR-2009-006115*
CR-2009-006043*	CR-2009-006065*	CR-2009-006099*	CR-2009-006117*

* CR written as a result of inspection effort

Drawings:

18002-0083SH0043, Elementary Diagram Emergency Fast Start Signal, Rev. 3
18002-0083SH0054, Elementary Diagram Electronic Governor Paralleling/Stop Signals, Rev. 5
18002-0083SH0057, Elementary Diagram Electronic Governor Load Signal, Rev. 3
18002-0083SH0070, Elementary Diagram Emergency SD & SD Due to Electrical Faults, Rev. 4
18002-0083SH0071, Elementary Diagram Emergency SD & SD Due to Electrical Faults, Rev. 3
18002-0083SH0072, Elementary Diagram Emergency SD & SD Due to Electrical Faults, Rev. 2
18002-0083SH0073, Elementary Diagram Engine 1 SD Due to Mechanical Faults, Rev. 4
25212-30021, 4.16 kV One Line Diagram Bus 34D [3ENS*SWG-B (-P)] Sh. 1 & 2, Rev. 13
383648, Elementary Wiring Diagram Differential Circuits & PT Circuit Bus 24 GE 4kV, Rev. 12
60583SH0001, Auxiliary Feedwater System, Rev. 63
60583SH0002, Auxiliary Feedwater System, Rev. 1
60620SH0007, Logic Diagram Saltwater Pump 13, Rev. 7
60620SH0007a, Logic Diagram Saltwater Pump 13, Rev. 9
60706SH0001, Service Water Cooling System, Rev. 51
60706SH0002, Service Water Cooling System, Rev. 75
60708SH0001, Circulating Salt Water Cooling System, Rev. 43
60708SH0002, Circulating Salt Water Cooling System, Rev. 108
60708SH0003, Circulating Salt Water Cooling System, Rev. 17
60710, Unit 1 Component Cooling System, Sh. 1, Rev. 43
60710, Unit 1 Component Cooling System, Sh. 2, Rev. 37
60710, Unit 1 Component Cooling System, Sh. 3, Rev. 45
60727SH0001, Diesel Generator Cooling Water, Starting Air, Fuel, & Lube Oil, Rev. 60
61001SH0001, Electrical Main Single Line Diagram, FSAR Fig. No. 8-1, Rev. 42
61005, Meter and Relay Diagram 4 kV System Buses 11 and 14, Rev. 35
61007SH0001, EDG Project Meter and Relay Diagram 4 kV System Unit Bus 17, Rev. 6
61009, Single Line Meter & Relay Diagram 480 Vac Unit Buses 11A, 11B, 14A & 14B, Rev. 40
61010SH0002, EDG Project Meter and Relay Diagram 480 Vac System Unit Bus 17, Rev. 3
61020SH0009, Power Panel Schedule Panel 113 (1P13), Rev. 14
61024, Single Line Diagram 125 Vdc Bus 11, Rev. 51
61024SH0002, Single Line Diagram 125 Vdc Bus 14, Rev. 3
61024SH0003, Single Line Diagram 125 Vdc Bus 15, Rev. 3
61025, Single Line Diagram 125 Vdc Buses 12 and 22, Rev. 30
61030, Single Line Diagram 120 Vac, 125 Vdc, and 250 Vdc, Rev. 31
61052SH0002, AC Schematic Diagram Unit Bus 17, Rev. 6
61058ASH0001, Logic Diagram ESFAS, Rev. 49
61068SH0004, AC Schematic Diagram Diesel Generator 1A, Rev. 8
61071SH0001, Schematic Diagram 4 kV Bus 11 Feeder Breaker 152-115, Rev. 19
61071SH0002, Schematic Diagram 4 kV Bus 11 Feeder Breaker 152-1101, Rev. 21
61071SH00A1, Schematic Diagram Typical 4 kV Feeder Breaker Operation, Rev. 25
61072CSHA1, Schematic Diagram Typical 480 Vac Load Center Breaker, Rev. 2
61072SHA2, Schematic Diagram Typical 480 Vac Load Center Breaker, Rev. 2

61085SH0009C, Schematic Diagram Heating and Ventilating Switchgear Room, Rev. 9
61-232-E, Underground Conduit West of Turbine Bldg Sections & Details, Rev. 8
61403SH0109D, System Flow Sheet LOCI Sequencers, Rev. 3
62437SH0001, Fuel Oil Storage & Transfer System, Rev. 4
62583, Auxiliary Feedwater System, Sh. 1, Rev. 57
62702SH0001, Condensate & Feedwater System, Rev. 43
62702SH0002, Condensate & Feedwater System, Rev. 41
62702SH0003, Condensate & Feedwater System, Rev. 45
62702SH0004, Condensate & Feedwater System, Rev. 46
62706SH0003, Service Water Cooling System, Rev. 6
62708SH0001, Circulating Water Cooling System, Rev. 33
62708SH0002, Circulating Water Cooling System, Rev. 106
62708SH0003, Circulating Water Cooling System, Rev. 7
62712SH0001, Compressed Air Systems, Rev. 52
62712SH0002, Compressed Air Systems, Rev. 72
62712SH0003, Compressed Air Systems, Rev. 112
62712SH0004, Compressed Air Systems, Rev. 22
62712SH0005, Compressed Air Systems, Rev. 0
62729SH0001, Reactor Coolant System, Rev. 99
62729SH0002, Reactor Coolant System, Rev. 10
63005SH0001, Meter and Relay Diagram 4 kV System Unit Buses 21 and 24, Rev. 32
63022, Single Line Diagram 120 Vac Vital System, Rev. 38
63024, Single Line Diagram 125 Vdc Bus 21, Rev. 38
63059, Schematic Diagram Engineered Safety Features Actuation System, Rev. 2
63071SH0007, Schematic Diagram 4 kV Bus-24, Feeder Breaker 152-2401, Rev. 17
63071SH0014D, Schematic Diagram 4 kV Bus 24 Bkr 152-2402 to Transformer 24A, Rev. 4
63076SH0002, Schematic Diagram Low Pressure Safety Injection Pump 22, Rev. 21
63076SH0007, Schematic Diagram Salt Water Pump 22, Rev. 20
63080SH0008, Schematic Diagram Saltwater Pump 23, Rev. 11
63086SH0003, Schematic Diagram 4 kV Bus-24 Diesel-2B Feeder Breaker 152-2403, Rev. 27
64304, Unit 1 Circulating & Saltwater Cooling System, Rev. 11
64305, Unit 1 Reactor Coolant System, Rev. 4
64307, Unit 1 Component Cooling Water, Rev. 4
64311, Unit 1 Safety Injection and Containment Spray, Rev. 10
64312, Unit 1 Auxiliary Feedwater, Rev. 1
64320, Unit 1 Starting Air, Fuel & Lube Oil, Rev. 10
64321, Unit 1 Starting Air, Fuel & Lube Oil, Rev. 7
64322, Unit 1 Starting Air, Fuel & Lube Oil, Rev. 9
83-165-A, BG&E/SACM Component ID Cross Reference List, Rev. 2
83641, Elementary Wiring Diagram, Unit 13 & 14 Breakers 2401/2402 4kV Switchgear, Rev. 22
83642, Elementary Wiring Diagram, Unit 15 & 16 Breakers 2403/2404 4kV Switchgear, Rev. 16
84304, Unit 2 Circulating & Saltwater Cooling System, Rev. 7
84305, Unit 2 Reactor Coolant System, Rev. 6
84307, Unit 2 Component Cooling Water, Rev. 4
84311, Unit 2 Safety Injection & Containment Spray System, Rev. 10
84312, Unit 2 Auxiliary Feedwater, Rev. 3
92-06-5063/001, Emergency Shutdown and Shutdown Due to Electrical Faults, Sh. 3A, Rev. 7
DLTC 2057, Instrument Data Sheets of Mechanical Installation, Rev. F
DLTC 2907, Instrument Design Basis 1E Instrumentation Design Bases Item 23.01, Rev. D

Miscellaneous:

BHEF1A, Control AFW Flow within 2 Hours After LOOP to Conserve CST, Rev. 0
BHEF1U, Control AFW Flow within 30 Minutes Given FCV Failure, Rev. 1
BHEF72, Operator Locally Starts AFW Pump within 45 Minutes of Auto Start Failure, Rev. 0
BHEF8B, Control AFW Flow During SBO within 30 Minutes Following Battery Failure, Rev. 0
BHEHXQ, Establish AFW Flow at 1(2)C43 (MCR Evacuated), Rev. 0
BHEK12, Start Standby CCW Pump, Rev. 1
BHEKZ1, Align & Start CCW Pump 13 to 480 Vac Bus 11B After CCW Pump 11 Fails, Rev. 0
BHESL2, Trip RCPs – Loss of CCW (Following Reactor Trip), Rev. 1
BHESL2, Trip RCPs within 45 Minutes After Loss of CCW Subsequent to Reactor Trip, Rev. 0
CAL-1-09-014891, Maintenance Review Strategy for Electrical 480 Vac MCCs, 5/20/09
Constellation Letter to NRC, GL 2006-02 60 Day Response, 4/3/06
Constellation Letter to NRC, GL 2006-02 Response to RAI, 1/3107
Constellation Letter to NRC, Response to GL 2006-02, 7/2607
Constellation Letter to NRC, Response to GL 2007-01, 5/7/07
Control Room Narrative Logs, 8/18/08
DGP-PM-94-224, Closure of AIT IR9402299, Issue Report IR0-053-207, 12/12/94
Letter from NRC to BG&E, Methodology for Postulating Passive Failure Pipe Breaks, 2/24/95
Maintenance Strategy for MCC 104R Main Feeder Breaker, 12/10/08
NEQR440, Setpoint File for System 024, 8/24/07
NRC Letter to BG&E, SE and Staff Positions for Emergency Power Systems, 6/3/77
OAP 94-5, Guidelines for Nuclear Plant Operations Support for System Operation and Planning Department Transmission System Operations Unit, Rev. 17
PMCR P-CAL-013138, Add a PM for E-048 Electrical Trip Test on the Battery Charger, 8/20/09
QP-054-016-1, Qualification Plan for NLI MCC Cubicles, Rev. 4
RAN 96-024SL, Unit 1 Plant Model RCP Seal Integrity, Rev. 2
Setpoint File for System 0036, Unit 1
Setpoint File for System 0037, Unit 1
System Health Report, Unit 1 Electrical 4 kV Transformers and Buses, Q-1 2009
System Health Report, Unit 2 Electrical 4 kV Transformers and Buses, Q-1 2009
System Health Report, Electrical 480 Vac Buses and Transformers, Q-2 2009
System Health Report, Unit 1 Electrical 13 kV Transformers and Buses, Q-1 2009
System Health Report, Unit 2 Electrical 13 kV Transformers and Buses, Q-1 2009
UCR No. 00203, Update UFSAR Section 9.5.2.2, 12/12/00
WCAP-16175-P, Model for Failure of RCP Seals Given Loss of Cooling, Rev. 0

Modifications & 10 CFR 50.59 Reviews:

92-B-011-186-R00, Safety Evaluation Form, 3/29/93
94-B-052-109-R00, Safety Evaluation Form, 2/1/95
ES200100565, Venting of 21 and 22 AFW Pump Turbine Bearings, Rev. 0
ES200500181, Overperformance of HPSI and CS Pumps during Large Flow Testing, Rev. 0

Procedures:

12087-017, Oil Immersed Transformers, Rev. 3
1C34-ALM, HVAC Systems Control Alarm Manual, Rev. 39
AOP-7C, Unit 1 Loss of Component Cooling Water, Rev. 3
AOP-7J, Unit 2 Loss of 120 Volt Vital AC or 125 Volt Vital DC Power, Rev. 14

AOP-7M, Major Grid Disturbances, Rev. 1
AOP-9A, Unit 1 Control Room Evacuation/Safe Shutdown Due to Control Room Fire, Rev. 15
CP-226, Specifications and Surveillance – Diesel Fuel Oil, Rev. 11
E-048, Inspection and Testing of Molded Case Circuit Breakers, Rev. 0
EOP-0, Post-Trip Immediate Actions, Rev. 11
EOP-1, Reactor Trip, Rev. 13
EOP-2, Loss of Offsite Power/Loss of Forced Circulation, Rev. 14
EOP-3, Loss of All Feedwater, Rev. 17
EOP-5, Loss of Coolant Accident, Rev. 23
EOP-7, Station Blackout, Rev. 16
EOP-8, Functional Recovery Procedures, Rev. 29
ERPIP-3.0 Attachment 27, Extensive Damage Mitigation Guidelines, Rev. 4400
ERPIP-3.0 Attachment 28, Extensive Damage Mitigation Guidelines, Rev. 4400
FTE-29, Acceptance Test and Calibration of Amptectors, Rev. 8
FTE-51, 4kV General Electric Magne-Blast Circuit Breaker Inspection, Rev. 01901
FTE-53A, Westinghouse 480 Volt Load Center Cubicle Maintenance, Rev. 0
FTE-59, Periodic Maintenance, Calibration and Functional Testing of Protective Relays, Rev. 5
MOV-009B, Operating the Crane Nuclear Viper System, Rev. 301
OI-16, Component Cooling System, Rev. 32
OI-21D, Fuel Oil Storage and Supply, Rev. 8
OI-27B, 13.8 kV System, Rev. 17
OI-32A, Auxiliary Feedwater System, Rev. 22
SP-616, Emergency Diesel Generator 1A & 0C, Rev. 0
STP O-5A-1, Auxiliary Feedwater System Quarterly Surveillance Test, Rev. 02200
STP O-73H-1, AFW Pump Large Flow Test, Rev. 8
STP-M-33-0, Inspection of 12 CST Vacuum Breaker Valves, Rev. 0
STP-M-584-1A, Leak Rate Test of 1A DG Air Receiver Inlet Check Valves, Rev. 00300
STP-M-673-2, PORV Response Time Test, Rev. 00703
STP-O-73B-1, Service Water Pump Performance Test, Rev. 01300
WP 3016, Guidelines For Visual Inspection and Dielectric Testing, 5/26/09
WPN 3002, Megger Insulation Resistance, 10/16/06
WPN 3005, Incipient Gas Meter, 4/19/06
WPN 3006, Fyrite Oxygen Analyzer, 5/13/06

Vendor Manuals & Specifications:

15138-002-1001, Installation and Operating Instructions for Flooded Batteries, Rev. 8
15735-013-1000, User's Manual Dual 125 V, 500 Amp Battery Charger, 12/93
6750-E-12, Specification for 15 kV Power Cable, Rev. 4
6750-E-13, Specification for 5 kV Power Cable, Rev. 4
6750-E-14s, Specification for 100 Volt Power Cable (Silicone Insulated), Rev. 4
6750-E-16, Specification for Instrumentation Cable, Rev. 4
72A-2244, Doble Test Procedures, Rev. A
CGG-PES-004, Rockbestos 600 Volt Power, Control, Instrument and Specialty Cable, Rev. 1
GEK-65535D, Instructions Static Voltage Relay Type SLV11A(-)A
SP0807 Appendix A, Engineering Data Series 5600 MCC Replacement Units & Starters, Rev. 5
VTM 12410-120, Low Voltage Power Circuit Breaker, Type DS and DSL, Rev. 34
VTM 12410-130, Low Voltage Power Circuit Breaker, Type DS and DSL, Rev. 1
VTM 12410-135, Cutler Hammer Overhaul/Refurbishment of DS Circuit Breakers, Rev. 6
Wyle Report 45808R97-02, Replacement MCC Pans, 1/13/98

Work Orders:

0200502317	1200501334	1200700757	2200403099
0200700255	1200501458	1200700757	2200501399
0200800459	1200501528	1200700964	2200501518
0206401442	1200502871	1200701255	2200600958
1200103283	1200504068	1200701256	2200701185
1200105109	1200600672	1200704003	2200800307
1200400042	1200605634	1200803892	2200800738
1200406415	1200700286	2199705752	

LIST OF ACRONYMS

AC	Alternating Current
AFW	Auxiliary Feedwater
CCNPP	Calvert Cliffs Nuclear Power Plant
CCW	Component Cooling Water
CFR	Code of Federal Regulations
CR	Condition Report
CST	Condensate Storage Tank
DC	Direct Current
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
HPSI	High Pressure Safety Injection
HRA	Human Reliability Analysis
ICV	Individual Cell Voltage
IEEE	Institute of Electrical and Electronics Engineers
IMC	Inspection Manual Chapter
IN	Information Notice
IP	Inspection Procedure
IST	In-service Testing
kV	kilo-Volts
kW	kilo-Watts
LOCA	Loss-of-Coolant Accident
MCC	Motor Control Center
MDAFW	Motor Driven Auxiliary Feedwater
MOV	Motor Operated Valve
NCV	Non-cited Violation
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
PORV	Power Operated Relief Valve
PRA	Probabilistic Risk Assessment
RAS	Recirculation Actuation Signal
RAW	Risk Achievement Worth
RCP	Reactor Coolant Pump
RECO	Reasonable Expectation for Continued Operability
RRW	Risk Reduction Worth
RWT	Refueling Water Tank
SBO	Station Blackout
SDP	Significance Determination Process
SPAR	Standardized Plant Analysis Risk
SUR	Sustained Undervoltage Relay
TDAFW	Turbine Driven Auxiliary Feedwater
TS	Technical Specification
TUR	Transient Undervoltage Relay
UFSAR	Updated Final Safety Analysis Report
Vac	Volts, Alternating Current
Vdc	Volts, Direct Current